BioE 543: DNA Biotechnology, Biophysics, and Modeling

Fall 2015

Course Description:

Semester-long course on fundamental properties of DNA, and their role in DNA biotechnology. Students will develop, analyze, and simulate simple biophysical models of DNA reactions, as well as learn and model methods of modern DNA biotechnology. Proficiency with MATLAB required.

Meeting Time & Location:

TTh 2:30pm - 3:45pm, BRC 285

Course Instructors

Dr. David Zhang — BRC Room 425
dyz1@rice.edu — Office Hours: by appointment

Teaching Assistants
Helen Yan — BRC Room 403
Yan.Yan@rice.edu — Office Hours: by appointment

Method of Instruction

This class will contain lectures, with 6 problem sets as homework. Please bring your Matlab-installed laptop whenever you attend class.

Course Information:

Course information, including problem sets and example solution sets, can be found at the course website: http://nablab.rice.edu/bioe543/

Course Readings

There is no textbook for this course. Reading materials are available on the course website.

Grading Criteria:

Students will be graded according to the following criteria.

Problem Sets	100%

Problem Sets:

Problem sets are due at the beginning of class on the due dates. A cumulating 5% late penalty will be applied for **every hour in which the problem set is late**. You may turn in your problem sets either physically in paper, or email them to your TA.

Grading Disputes:

If you believe that a mistake has been made in grading your problem sets or exams, please first consult your TA. If you cannot reach satisfactory resolution with your TA, you may

appeal to Dr. Zhang, but be warned that a failed appeal will result in **a grade penalty** of -5% on the relevant problem set.

Honor System Policy:

Students are expected to adhere to the Honor Code and follow the guidelines given in the Blue Book. Exams are given under the honor system. Students are encouraged to bring any concerns involving academic integrity to the attention of the instructor. More information can be found at honor.rice.edu

Schedule:

Thurs 8/23	1: Two-state Model of DNA Hybridization	
Tues 8/25	2: Watson-Crick Thermodynamics	
Thurs 8/30	3: Melting Temperatures and Curves	PS 1 out, Last day to add
Tues 9/1	4: Hybridization Mismatches and Tm	
Thurs 9/6	5: Partition Functions and Equilibrium	
Tues 9/8	6: Dangles and Partition Functions	
Thurs 9/13	7: Mismatches and Partition Functions	PS 1 due, PS 2 out
Tues 9/15	8: Hybridization Kinetics in the Two-State Model	
Thurs 9/20	9: Strand Displacement Modeling and Kinetics	
Tues 9/22	10: Kinetic Modeling in Complex Mixtures	
Thurs 9/27	11: Rare SNV Detection - Equilibrium vs. Pre-equilibrium	PS 2 due, PS 3 out
Tues 9/29	12: Elementary Step Modeling	
Thurs 10/4	13: Kinetics Data Fitting	Last day to drop
Tues 10/6	14: Kinetics Data Fitting	
Thurs 10/11	NO CLASS (Institute: Midterm break)	PS 3 due, PS 4 out
Tues 10/13	15: Exact String Matching	
Thurs 10/18	16: Approximate String Matching	
Tues 10/20	17: Sequence Alignment	
Thurs 10/25	18: Nussinov Algorithm (guest lecture by John Fang)	PS 4 due, PS 5 out
Tues 10/27	19: Orthogonal Sequence Design	
Thurs 11/1	20: Sequence Design for Strand Displacement Probes	
Tues 11/3	21: Diagnostic Specificity, Sensitivity, and ROC	
Thurs 11/8	22: ROC Parameter Fitting	
Tues 11/10	23: RNA expression profiling	
Thurs 11/15	24: RNA expression profiling	PD 5 due, PS 6 out
Tues 11/17	25: Non-linear parameter fitting	
Thurs 11/22	26: Non-linear parameter fitting	
Tues 11/24	NO CLASS (Institute: Thanksgiving day)	
Thurs 11/29	27: Aptamers (guest lecture by Ale Pinto)	PS 6 due
Tues 12/1	NO CLASS	
Thurs 12/6	NO CLASS	